is a scheme for corn breeding worked out in very clear detail by C. G. WILLIAMS, by which it is hoped to secure the greatest possible improvement without encountering the injurious effects of inbreeding. In the rapid development of all breeding problems, due to the universal interest which is being taken both in scientific and economic aspects of the subject, the annual reports of the American Breeders' Association must continue to be a most valuable source of information as to the present state of knowledge, and no one who is interested in these problems from either point of view can afford to be without the annual volumes.—GEORGE H. SHULL.

NOTES FOR STUDENTS

Ascent of water.—EWART becomes a stronger and stronger opponent of the DIXON-JOLY theory of the ascent of sap, and in his last paper[9] adduces some powerful arguments, backed by observations, against it and in favor of the theory of vital maintenance of suitable conditions for conduction and some sort of pumping action. The latter may be by surface tension, but while theoretical ways abound in which this might be applied, no practical proof of the existence of any such action in wood is forthcoming. EWART's experiments all tend to show, he thinks, that the continuous ascent of water is possible only in living wood, and that the power of conduction is rapidly lost at death. Experiments on the suction and exudation of trees at different levels showed no continuous water columns or high internal tensions in the tracheae during active transpiration, and this fact, coupled with the high total resistance to flow, indicates that this resistance is overcome locally from point to point, and not by enormous tension from above, which leads to blocking by gas bubbles, nor by pressure from below, which leads to great loss by lateral exudation from the vessels.

EWART makes several corrections of his own and others' previous observations. He finds no vessels open the whole length of the tree, as STRASBURGER thought to be the case in oak. Wistaria furnished him the longest—5.64^{m}. In the oak they are seldom over 1^{m}. Nor does EWART sustain STRASBURGER's results on the conduction of water through dead wood, for if these experiments are sound, vital action is out of the question. His own earlier observations on the osmotic pressures in leaves at different levels are also disowned, for he now finds as great differences in leaves at the same level. Incidentally he looked up the evidence as to the height of the tallest trees in Australia, and concludes that none appreciably exceed 300 feet, instead of being 472 as reported. He thinks that the height of some of our American big trees may likewise shrink on investigation.

In the course of the discussion of exudation he makes the very good point that fully turgid cells, for example, those of the root cortex, may act simply as a membrane between the water in the vessels and the outside water, their own osmotic pressure, however high, having no influence on the transfer of water from soil to vessel so long as they remain fully turgid. This also explains how cells of unlike

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[9] EWART, A. J., The ascent of water in trees (second paper). Phil. Trans. Roy. Soc. London B **199**:341–392. 1908.

osmotic pressure can exist side by side without those of higher pressure draining those of lower, which, however, they would do as soon as their turgor was relaxed ever so slightly, thus releasing some of the osmotic energy that had previously been expended against the wall. This point has been often overlooked.

URSPRUNG[10] makes what he himself properly calls "a small contribution" (which nevertheless fills sixty-odd pages!) to a more extended study of the relation of live cells to the ascent of water in woody plants. His data will be more useful than his interpretation. The experiments, carried on in the forests, embraced five species of gymnosperms and fifteen of angiosperms. The axes were killed for greater or less distances at various levels by steam, and usually others were girdled at the same time. Microscopic examination was made of both dead portions and neighboring parts. URSPRUNG explains the dissimilar behavior of different species on the assumption (and therefore begs the question) that the experimental interference eliminates the vital component of the lifting forces, but does not affect the physical; so as the vital factor is greater or less the wilting of the leaves occurs in a few days in some experiments or is delayed to 100 in others. His "results" he summarizes thus: "In all the plants investigated a participation of the living cells in the production of the lifting force is to be assumed." (Is this a *result?*) "Water conduction occurs chiefly in the younger layers of the wood." (This has been long known.) "In all observed plants the cortex must be present in order to make possible the continuance of a sufficient water movement; its removal acts injuriously, though not everywhere equally. The significance of the cortex for the ascent of sap lies probably in its protective function for the periphery of the wood." (This has scarcely been doubted.) "For a sufficient water-movement a small fraction of the conducting tissues suffices, if in the part remaining the wood cells be living." (The *if* is not a condition proved but assumed.) "The force component arising from the living cells attains great significance in comparison with the purely physical." (*Quod est demonstrandum.*) —C. R. B.

Items of taxonomic interest.—C. B. CLARKE (Contrib. U. S. Nat. Herb. **10**:443–471. 1908), before his death, had prepared a synopsis (in Latin) of the Cyperaceae of Costa Rica. This has now been published, with such changes as were necessary, such as translation into English (by E. L. GREENE), rearrangement of synonymy, completion of citations, elimination of *nomina nuda*, etc. A synoptical key to the 19 genera precedes the presentation of the 105 species. The large genera are Rynchospora (16), Cyperus (15), Eleocharis (13), and Scleria (11), and a single new species is described in each of the following genera: Cyperus, Rynchospora, and Carex.—J. J. SMITH (Bull. Dept. Agric. Ind. Néerland. no. 13. pp. 78. *pls. 2.* 1907), in the first of a series of papers on the orchids of Java, has described 15 new species and 2 new genera (*Silvorchis* and *Lectandra*).—E. ULE (Notizblatt **5**: no. 41*a*. pp. 52. *pls. 4.* 1908), in connection with an account of the

[10] URSPRUNG, A., Abtötungs- und Ringelungsversuche an einigen Holzpflanze. Jahrb. Wiss. Bot. **44**:287–349. *pl. 4.* 1907.